

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Schuegraf, et al.) Group Art Unit 2811
)
 Appl. No. : 08/932,228) I hereby certify that this correspondence and all
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 Filed : September 17, 1997) mail in an envelope addressed to: Assistant
) Commissioner for Patents, Washington, D.C.
) 20231, on
)
 For : SHALLOW TRENCH) December 19, 2002
) ISOLATION USING LOW) (Date)
) DIELECTRIC CONSTANT) *M. T. Morley*
) INSULATOR) Marc T. Morley, Reg. No. 52,051
)
 Examiner : H. Vu)

ON APPEAL TO THE BOARD OF PATENT APPEALS AND INTERFERENCES
SUPPLEMENTAL APPEAL BRIEF

Box AF
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 Arlington, VA 22202

Dear Sir:

In response to the Notice of Non-Compliance mailed on November 20, 2002, Applicants are resubmitting the Supplemental Appeal Brief, first filed on July 12, 2002, with a revised concise statement of issues presented in compliance with 37 C.F.R. § 1.192(c)(6).

Furthermore, in response to Office Action mailed on March 13, 2002, Appellants maintain their request for reinstatement of the Notice of Appeal filed on August 31, 2001 and for reinstatement of the Appeal Brief ("Appellants' Brief") filed on October 30, 2001. This resubmitted Supplemental Appeal Brief incorporates and supplements Appellants' Brief.

I. REQUEST FOR REINSTATEMENT

Appellants respectfully request reinstatement of the appeal filed on August 31, 2001, under 37 C.F.R. § 1.193(b)(2).

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II. SUPPLEMENTAL ISSUES BEFORE THE BOARD

This appeal turns on two issues:

First, whether Claims 21, 22, and 24 are properly rejected under 35 U.S.C. § 102(a) as being anticipated Anjum et al. ("Anjum") (U.S. Patent No. 5,372,951). This issue turns on whether the cited reference discloses the claimed structures and features of the properly construed claims. A corollary issue is whether it is improper in determining anticipation to ignore a "process limitation" (as characterized by the Examiner) that is used as an adjective and which adequately defines the physical structure and characteristics of the device.

Second, whether Claims 11-16 and 21-24 are properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Bose et al. ("Bose") (U.S. Patent No. 5,492,858) in view of Nishiyama et al. ("Nishiyama") (U.S. Patent No. 5,429,995). The issue turns on whether the cited references themselves provide any teaching, suggestion or motivation to combine, or if the Examiner incorrectly has used impermissible hindsight to find some motivation to combine.

III. APPELLANTS' ARGUMENT

A. Summary of Previously Appealed Rejection and Appellants' Previous Arguments

Claims 21, 22, and 24 were previously finally rejected, and remain rejected in the Office Action mailed on March 13, 2002, under 35 U.S.C. § 102(a) as being anticipated by Anjum et al. ("Anjum") (U.S. Patent No. 5,372,951). The previous final rejection was appealed on August 31, 2001. As explained in greater detail in Appellants' Brief, the Examiner has refused to recognize an explicit feature of Claim 21 that is not present in Anjum. The claimed feature describes a structure that is *different* from any structure in Anjum. The Examiner refuses to recognize the claimed feature, characterizing it as a product by process element. The Examiner has misapplied the guidance of M.P.E.P. § 2113 with respect to product by process law, which section applies to

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situations where the claimed structure is the *same* as the structure found in the cited reference, which is not the case here. Because Anjum fails to disclose each and every feature of Claim 21, it cannot anticipate the claim.

Also, Claims 11-16 and 23 were rejected under 35 U.S.C. § 103(a) as being obvious over Bose in view of Anjum. The Examiner did not raise this rejection in the Office Action mailed on March 13, 2002. Presumably, the Examiner's statement that "Applicant's arguments with respect to Claims 11 and 21 have been considered but are moot in view of the new ground(s) of rejection," refers to the fact that this obviousness rejection has not been maintained.

However, in the Office Action mailed on March 13, 2002 the Examiner continued to reject the Claims for reasons that are not really different from those that were previously presented. Specifically, the Examiner has continued to reject Claims 11-16 and 23 under 35 U.S.C. § 103(a), with the only change being the replacement of Anjum with Nishiyama. The Examiner still fails to provide motivation for combining a halide teaching, Nishiyama, with Bose, as explained in greater detail below.

Further, with regard to the rejection under 35 U.S.C. § 102(a), the Examiner has maintained the very same product by process arguments, continuing to refuse to recognize the distinguishing claim features. Thus, all of the arguments made in Appellants' Brief continue to apply in principle to the instant rejections.

B. Claims 21, 22 and 24 are not anticipated because the Claims recite a structural limitation not taught by Anjum

Claims 21, 22 and 24 remained rejected under 35 U.S.C. § 102(a) as being anticipated by Anjum. The Examiner continues to refuse to acknowledge the substance of Claim 21, instead relying upon an erroneous application of M.P.E.P. procedure. Independent Claim 21 recites a

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distinct structure that is different from any structure disclosed in Anjum. As stated in Appellants' Brief, Anjum disclosed the distinct "bird's beak" structure. In contrast, Claim 21 recites a trench structure that is characterized, not by a "bird's beak," but instead by a steep sidewall profile. Therefore, Claim 21 is not anticipated by Anjum because Anjum does not include the same or similar structure..

Furthermore, M.P.E.P. § 2113 does not apply to the instant case. It sets forth that, "[o]nce the examiner provides a rationale tending to show that the claimed product appears to be the *same or similar* to that of the prior art, although the produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product." (emphasis added) *In re Marosi*, 710 F.2d 798, 802 (Fed. Cir. 1983). Here, as explained above, the claimed structure is not the same as or similar to any structure disclosed in Anjum. Therefore, the guidance and rationale of M.P.E.P. § 2113 do not apply to the present scenario and the Examiner should consider the all of the features of Claim 21.

Accordingly, for the reasons set forth above and those previously submitted in Appellants' Brief, Appellants respectfully request withdrawal of the rejections for anticipation under § 102(a), and submit that Claim 21 and its dependent Claims 22 and 24 are allowable over the art of record.

C. Claims 11-16 and 21-24 are not obvious because neither reference provides any motive or suggestion to combine absent the use of impermissible hindsight.

Claims 11-16 and 21-24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Bose in view of Nishiyama. According to the Examiner, Bose disclosed an isolation structure comprising each claim feature except for "silicon oxide comprising a halide dopant." The Examiner asserts that Nishiyama disclosed "an insulating film for electrically [*sic*] isolation comprising silicon oxide comprised halide dopant." The Examiner summarily concludes that it

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would have been obvious to one of ordinary skill in the art to combine the cited references to form the recessed portion of Bose having halide-doped silicon oxide. Thus, the Examiner has not provided any specific discussion supporting a *prima facie* case of obviousness of Claims 21-24. Further, the discussion below illustrates the undesirability and lack of motivation to combine the references as they relate to those Claims.

To establish a *prima facie* case of obviousness “[t]he references themselves, not the invention itself, must provide some teaching whereby the applicant’s combination would have been obvious.” *In re Gorman*, 933 F.2d 982 (Fed. Cir. 1991); *Heidelberger Druckmaschinen AG v Hantscho Commercial Products, Inc.*, 21 F.3d 1068 (Fed. Cir. 1993).

“Obviousness can not be established by hindsight combination to produce the claimed invention. . . . [I]t is the prior art itself, and not the applicant’s achievement, that must establish the obviousness of the combination.” *In re Dance*, 160 F.3d 1339 (Fed. Cir. 1998). “Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references.” *In re Dembiczak*, 175 F.3d 994 (Fed. Cir. 1999); *see also Epochem, Inc. v. Southern California Edison Co.*, 227 F.3d 1361 (Fed. Cir. 2000).

Bose did not provide any teaching, suggestion or motivation to combine with Nishiyama. The invention of Bose related to a method of planarization in integrated circuit manufacture where shallow trench isolation is employed. *See Bose*, Field of the Invention at col. 1, lines 6-10. Bose disclosed shallow trench isolation, using a conventional silicon oxide along with a silicon nitride liner. *See Bose*, Abstract and col. 4, lines 42-44. Bose did not express any suggestion or motivation to utilize a low dielectric constant material. *See Bose* throughout. In fact, the Claims of Bose are specifically limited to “undoped” dielectric or silicon oxide. *See Bose*, Claims 1 and

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10. Moreover Bose stressed the critical importance of using a silicon nitride liner 18. *See* Bose, col. 3, lines 57-60; col. 5, lines 41-47. As the skilled artisan will readily appreciate, the silicon nitride liner *increases the overall dielectric constant* in the trench isolation structure of Bose, relative to a pure silicon oxide element.

Moreover, the skilled artisan would not be motivated to combine the high temperature process as disclosed in Bose with the aluminum wiring isolation process as disclosed in Nishiyama. Nishiyama failed to provide any teaching, suggestion or motivation to be combined with Bose. As mentioned previously, Bose disclosed a trench structure that is filled with a dielectric material for field isolation among transistors within a semiconductor substrate, whereas Nishiyama primarily disclosed film isolation of aluminum wiring. *See* Nishiyama, Summary of the Invention at col. 2, lines 30-41; Figures 2(A-C), 8(A-D), and 11(A-B) (Appendices E-G); Examples 1, 2, and 4. Nishiyama used plasma chemical vapor deposition ("pCVD") to form the insulating films. *See, for example*, Nishiyama, col. 2, lines 30-41; column 3, lines 31-35.

The skilled artisan might have recognized the use of pCVD to deposit an insulating film to cover an aluminum line. However, the skilled artisan would not be motivated, and Nishiyama provides no motivation, to use Nishiyama's pCVD film process with the shallow trench planarization methods of Bose in order to fill the shallow trenches of Bose. The Examiner has not specified any motivation beyond concluding that it would have been obvious to combine the references. Furthermore, the plasma from the pCVD process would be expected to damage exposed silicon structures at the early fabrication stage of Bose. The rejections simply gloss over the very different contexts of Nishiyama and Bose, under the *assumption* that the skilled artisan would have desired the low dielectric constant of Nishiyama for the shallow trench isolation of Bose.

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In sum, the skilled artisan would not be motivated to combine Bose which discloses methods for planarization of circuits using shallow trench fill with Nishiyama which attempted to put an isolating film layer onto an aluminum wire. Only using impermissible hindsight in an attempt to reconstruct the claimed invention does the Examiner combine these references.

Furthermore, the requisite motivation is not automatically provided by virtue of the fact that the references are from the same industry. There must be some specific motivation to combine the references in the manner asserted by the Examiner, which motivation is not present in this case. Again, here, the Examiner is using impermissible hindsight, rather than some teaching from the references themselves.

Accordingly, for all of the above-mentioned reasons and the reasons previously submitted, Appellants request withdrawal of the rejections for obviousness, and respectfully submit that the Claims are allowable over the art of record.

IV. CONCLUSIONS

To summarize, Appellants submit that Claims 21, 22, and 24, on appeal, are patentable because (1) independent Claim 21 recites "a trench within the substrate, the trench having a characteristic profile produced by an etch process," which is a structural feature and not a product-by-process limitation; (2) the structural feature is not disclosed in Anjum; and, (3) the cited Anjum reference did not teach each and every element of Claim 21, when the claim is properly construed to include structural features, rather than mere product-by-process limitations. Furthermore, Claims 11-16 and 21-24 are patentable over the asserted combination because the Examiner has failed to provide any teaching, suggestion or motivation from the prior art to combine the asserted references. There is no motivation to combine the references absent impermissible hindsight.

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V. APPENDIX D

Attached hereto as Appendix D is a copy of the appealed Claims.

VI. APPENDIX E

Attached hereto as Appendix E is a copy of Figures 2(A-C), 8(A-D), and 11(A-B) from the prior art reference Nishiyama et al. U.S. Patent No. 5,429,995.

VII. APPENDIX F

Attached hereto as Appendix F is a copy of Figures 8(A-D) from the prior art reference Nishiyama et al. U.S. Patent No. 5,429,995.

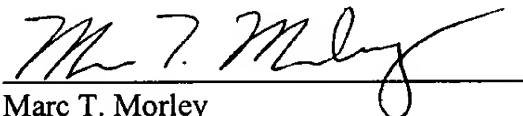
VI. APPENDIX G

Attached hereto as Appendix G is a copy of Figures 11(A-B) from the prior art reference Nishiyama et al. U.S. Patent No. 5,429,995.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 12/19/02

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APPENDIX D

11. (Twice Amended) An isolation structure in a semiconductor substrate comprising:
a recessed portion formed with a vertical sidewall within the semiconductor substrate; and
a dielectric material comprising a halide-doped silicon oxide filling the recessed portion, said dielectric material having a dielectric constant lower than the dielectric constant of silicon dioxide.
12. (Amended) The isolation structure of Claim 11, wherein the recessed portion comprises a trench structure having a ratio of height to width of less than 2:1.
13. The isolation structure of Claim 11, wherein the recessed portion comprises a trench structure having a depth of less than 200 nm.
14. The isolation structure of Claim 11, further comprising a barrier layer disposed between the recessed portion of the semiconductor substrate and the dielectric material.
15. The isolation structure of Claim 11, wherein the dielectric material has a dielectric constant lower than 3.9.
16. The isolation structure of Claim 11, wherein the dielectric material comprises a Fluoride-doped silicon dioxide composition.
21. An integrated circuit having a plurality of a isolation regions within a semiconductor substrate, each isolation region defined by:
a trench within the substrate, the trench having a characteristic profile produced by an etch process; and
a halide-doped silicon oxide filling the trench to form an isolation element, an interface between the isolation element and the substrate retaining the characteristic profile of the trench.
22. (Amended) The integrated circuit of Claim 21, wherein the halide-doped silicon oxide has a dielectric constant of less than 3.9.

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23. The integrated circuit of Claim 21, further comprising a barrier layer disposed between the interface of the semiconductor substrate and the dielectric material.

24. The integrated circuit of Claim 21, wherein the halide-doped silicon oxide comprises fluoride-doped silicon dioxide.

APPENDIX E

Figures 2(A-C) from Nishiyama et al. U.S. Patent No. 5,429,995

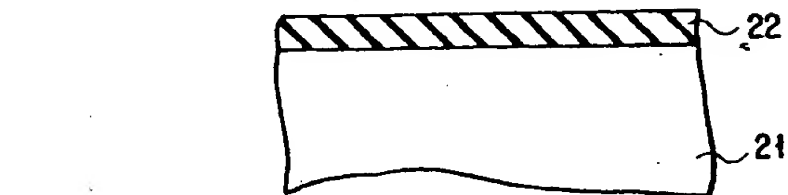


FIG. 2A

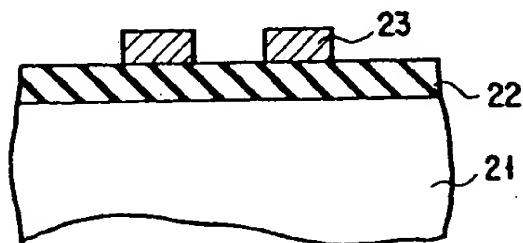


FIG. 2B

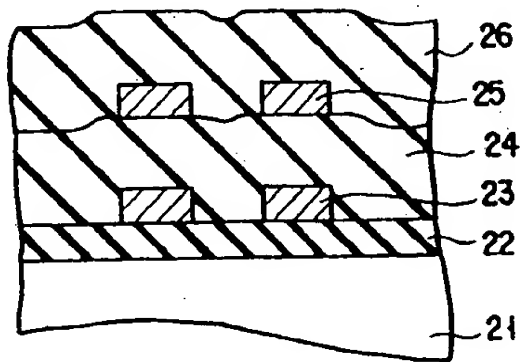
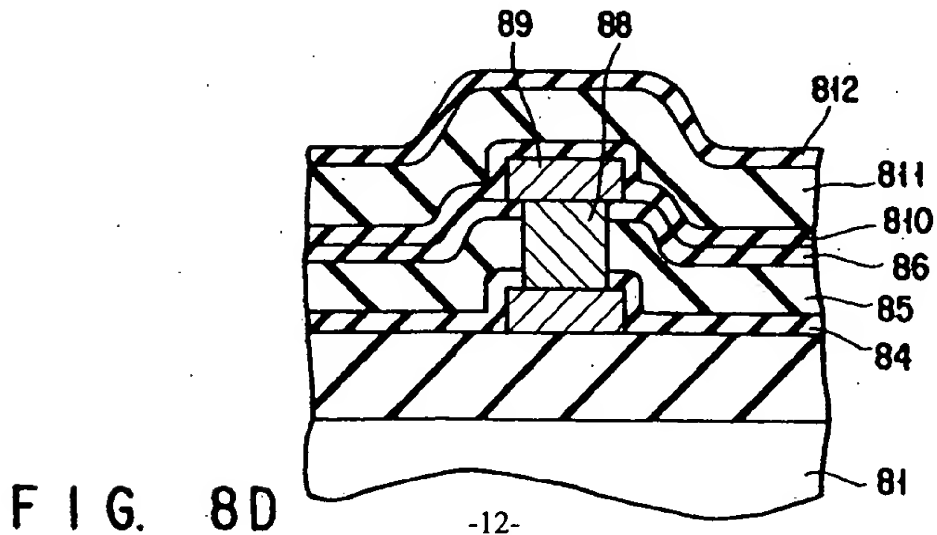
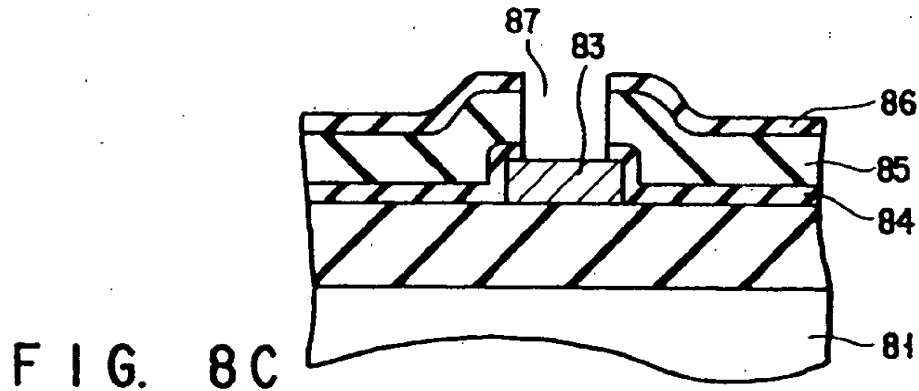
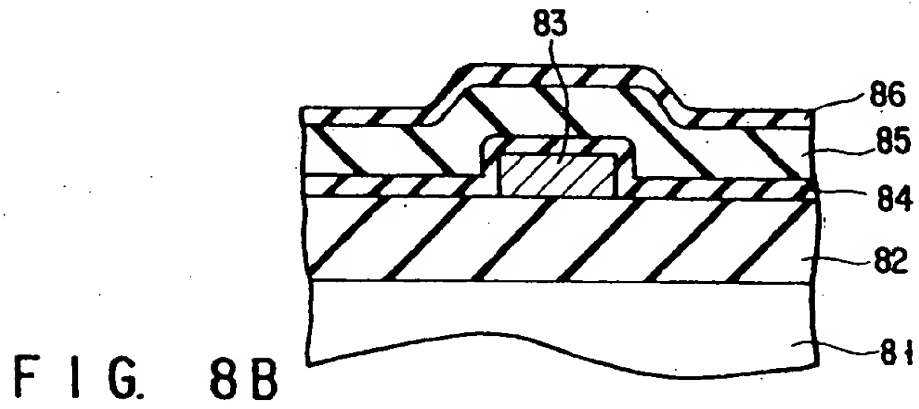
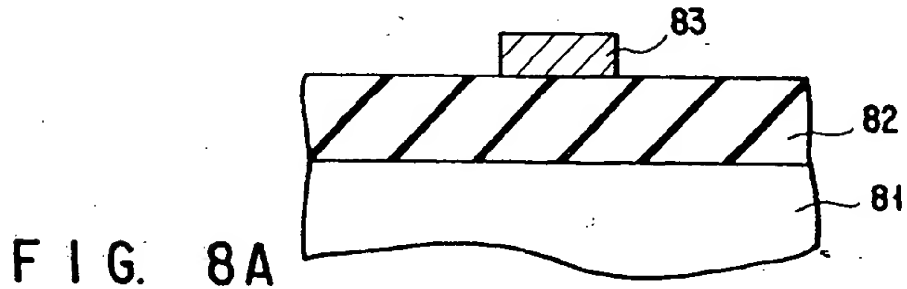


FIG. 2C

APPENDIX F

Figures 8(A-D) from Nishiyama et al. U.S. Patent No. 5,429,995



APPENDIX G

Figures 11(A-B) from Nishiyama et al. U.S. Patent No. 5,429,995

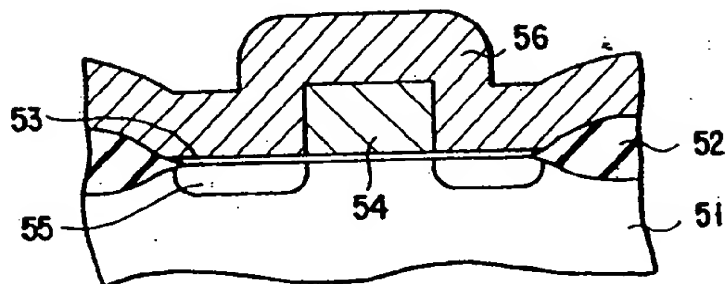


FIG. 11A

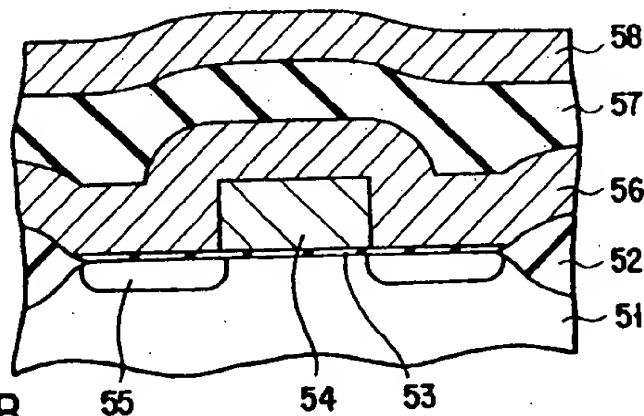


FIG. 11B